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Albany International Techniweave, Inc.  
Rochester, New Hampshire

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## Albany International Techniweave, Inc

- Techniweave was acquired by Albany in 1998
- Albany's sales exceed 850 Million Dollars/year
- Fabricating High Temperature seals since 1991
- Techniweave will have a new facility in 90 days

**Albany International Techniweave**

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Albany International is the world's leading suppliers of Paper Machinery Clothing. Albany acquired Techniweave in March of 1998 and combined it with the Engineered Products Group of the Albany International Research Company (AIRESKO), Mansfield Massachusetts. The combined organization is known as Albany International Techniweave, Inc.. Techniweave and the Engineered Products Group provided products and services to many of the same customers and were viewed as complimentary businesses.

## New Facility



- 4th quarter '99 scheduled completion
- co-locate personnel and equipment from our current Rochester, NH and Mansfield, MA operations
- located in Rochester, NH within 5 miles of existing facility
- 4800 sq. ft. office area / 60,000 sq. ft. manufacturing area
- site preparation to accommodate future 60,000 sq. ft. expansion of manufacturing area as business requires

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This facility will be the new home of Albany International Techniweave Inc. It is anticipated that all equipment and personnel will be relocated in January of 2000. The site allows for the expansion of the base building on an incremental basis as needed.

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## The Ideal Seal...A High Temperature Elastomeric O-Ring

- No leakage
- Infinitely compressible
- Unlimited spring back
- No temperature limitation

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The ideal high temperature seal would have the same properties as an elastomeric O-ring but without the temperature limitations.

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## Reality of Ceramic Fiber Seals

- The seal will leak
- If the seal is compressed too far the fiber turns to powder
- Only limited spring back is realistic
- There are temperature limitations and the higher the temperature the more difficult the fiber is to work with

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The reality of high temperature seals is often far from the ideal. Engineers are forced to find innovative methods for utilizing ceramic seals.

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## The Raw Materials

- Ceramic fiber yarns
  - Nextel 312
  - Nextel 440
  - Nextel 550
  - Nextel 610
  - Nextel 720
  - Altex

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Ceramic seals can be fabricated from a number of commercially available yarns. The specific yarn choice is guided by the max use temperature and the environment. Typical prices for yarns range from \$75 to \$750 per pound.

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## The Raw Materials, cont'd

- High temperature alloy wire
  - Haynes 188
  - Inconel
  - Stainless steel

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Hybrid braids, (ceramic core with metallic sheath) offer increased environmental resistance where vibration and/or air flow past the seal is anticipated

## Nextel Ceramic Fiber Typical Properties

Nextel 312, 440, 550, 610 & 720

Property	Units	Nextel 312	Nextel 440	Nextel 550	Nextel 610	Nextel 720
Filament Diameter	μm	10-12	10-12	10-12	10-12	10-12
Crystal Type		9Al <sub>2</sub> O <sub>3</sub> : 2B <sub>2</sub> O <sub>3</sub> + amorph. SiO <sub>2</sub>	gamma Al <sub>2</sub> O <sub>3</sub> + mullite + amorph. SiO <sub>2</sub>	gamma Al <sub>2</sub> O <sub>3</sub> + amorph. SiO <sub>2</sub>	alpha Al <sub>2</sub> O <sub>3</sub>	alpha Al <sub>2</sub> O <sub>3</sub> + mullite
Density	g/cm <sup>3</sup>	2.70	3.05	3.03	3.88	3.40
Filament Tensile Strength (25.4mm gauge)	Mpa ksi	1700 250	2000 290	2000 290	2930 425	2100 300
Filament Tensile Modulus	Gpa msi	150 22	190 27	193 28	373 54	260 38
Chemical Composition	wt%	62 Al <sub>2</sub> O <sub>3</sub> 24 SiO <sub>2</sub> 14 B <sub>2</sub> O <sub>3</sub>	70 Al <sub>2</sub> O <sub>3</sub> 28 SiO <sub>2</sub> 2 B <sub>2</sub> O <sub>3</sub>	73 Al <sub>2</sub> O <sub>3</sub> 27 SiO <sub>2</sub>	>99 Al <sub>2</sub> O <sub>3</sub>	85 Al <sub>2</sub> O <sub>3</sub> 15 SiO <sub>2</sub>
Allowable Yield Variation	yds/lb.	specified ± 10%	specified ± 10%	specified ± 10%	specified ± 10%	specified ± 10%

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The data included here is copied from the 3M Nextel data handbook. The yield of the incoming material is indicated as +/- 10%. This potential variability presents special challenges to the fabricator and the end user.

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## Fabrication of a Simple Parallel Fiber Seal

- Pros
  - High fiber volume
  - Simplicity
- Cons
  - Stiff, buckles when bent
  - Low compressibility
  - Low resiliency

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Some of the earliest seals were fabricated by over-wrapping an inner core of parallel fibers. This construction is still favored for some specific applications. The seal has relatively low leakage but lacks flexibility and resiliency.



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## Braided Seal Fabrication

- Pros
  - Flexible
  - Tailorable
    - Size
    - Permeability
    - Resiliency
  - Resistance to wear
  - Diameters from .05" to .5"
- Cons
  - Requires more labor

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Braided seals consist of a minimal core with layer over layer of braided ceramic fibers. The characteristics of the seal can be tailored to fit the specific application. The multiple layers increase the labor costs significantly. However, the resulting seals are conformable and can be provided in a wide range of materials and architectures.

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## Braid Descriptors

- Number of carriers
- Braider configuration
- Yarn base material
- Yarn ply and twist
- Diameter of material to be braided
- Plaits per Inch
- Tension

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These descriptive terms are used to provide a definition of the braid and its architecture. Each layer in a seal would have its own description.

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## Seal Descriptors

- Diameter
- Materials of construction
- Compressibility
- Resiliency
- Fiber volume
- Leakage

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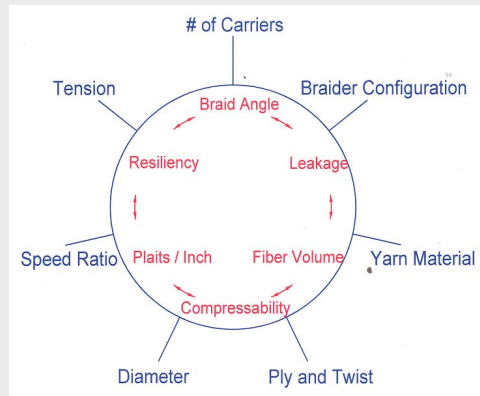
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A finished seal can be described the these characteristics.

## Braid Variables



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The braiding parameters shown in blue can be changed independently of each other and will effect all of the characteristics shown in red. It is impossible to change any of the seal characteristics shown in red without effecting all of them. Thus the fabrication of a textile braid differs greatly from other manufacturing processes. The braid is a study in equilibriums, where all of the properties are interactive and cannot be held constant while changing only one variable.